therefore of fundamental importance in fish culture. Although little is known yet as to which plant species are best for oxygenation, it is probable that evergreen species with finely divided leaves are the most satisfactory. It has long been known, of course, that plants are the basis of all fish food, but we are only just beginning to determine which species have the greater food values. Another thing of importance is the determination of the optimum association of species in a pond.—H. C. COWLES.

Cytology of Synchytrium and Urophlyctis.—Within a year considerable light has been shed on the puzzling problems of cytomorphology in the Chytridiales by reinvestigations of *Synchytrium* (*Chrysophlyctis*) *endobioticum* and *Urophlyctis alfalfae*. The careful and thorough studies of Miss CURTIS[7] on *Synchytrium* and of JONES and DRECHSLER[8] on *Urophlyctis* deserve particular notice. The most noteworthy results of Miss CURTIS' study of *Synchytrium* are the establishment of the occurrence of gametic fusions in the life cycle and the demonstration that a prosorus is regularly antecedent to the development of the sporangial sorus, the contents of this body passing into the host cell where segmentation into sporangia and production of zoospores take place. During the development of the prosorus from the infecting zoospore a series of nucleolar discharges of chromatin occurs, and the five chromosomes originate also from the nucleolus; but all divisions from the primary nucleus to the zoospore primordia are typically mitotic. The asexual or sexual nature of the motile cells terminating this series appears to depend on the availability or lack of water during maturation; if water becomes tardily available simultaneous germination of a number of sporangia occurs and their zoospores pair, probably exogamously. Unpaired zoospores and zygotes penetrate growing parts of potato plants; the former reproduce the prosorus phase, but the zygotes develop into resting sporangia. In the production of the latter no form of mitotic division was observed. Chromatic granules appear in the cytoplasm following nucleolar discharges, and after a further loss of chromatin (a process homologized with reduction) the granules become zoospore primordia. The existence of sexual fusions between facultative gametes is hypothecated for all Synchytriaceae which produce true resting spores. The validity of *Chrysophlyctis* is rejected, and the writer prefers the broader generic name *Synchytrium* to *Pycnochytrium*, to which the organism in all respects conforms.

The absence of mitosis in the development of the resting sporangium and the conception of nucleolar gemmation taking the place of meiotic divisions

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[7] CURTIS, K. M., The life history and cytology of *Synchytrium endobioticum* (Schilb.) Perc., the cause of wart disease in potato. Phil. Trans. Roy. Soc. London. B **210**:409–478. *pls. 12–16*. 1921.

[8] JONES, F. R., and DRECHSLER, CHARLES, Crown wart of alfalfa caused by *Urophlyctis alfalfae*. Jour. Agric. Res. **20**:295–324. *pls. 47–56*. 1920.

will still be unsatisfactory to cytologists who hope to standardize the essentials of nuclear behavior practically throughout the plant realm; and the conviction will persist that imperfect fixation within the resistant walls of the resting body has masked the appearance of mitotic divisions conforming to those of the prosorus in this species, of the resting sporangium in *S. decipiens* and *S. puerariae*, of *Rhodochytrium*, and others.

This work affords no support to the view advanced by ORTON[9] and KERN that the "primordial sphere" in *Synchytrium* is a chimera composed of a parasitic plasmodium enveloping an almost unmodified host nucleus. Figures of the type on which this view is based are interpreted as resulting from multiple infections, by which a number of zoospores come to lie about a single host nucleus. Subsequent divisions of the host cell distribute the supernumerary spores, leaving usually only one in each host cell. The reviewer, however, has observed two and even three cysts within one host cell in all stages of development up to resting sporangia. Furthermore, a series of preparations is readily obtained showing that, contrary to the view of ORTON and KERN, the primary nucleus of the cyst is the direct outgrowth of the zoospore nucleus, the host cell nucleus being crowded off to one side of the cyst, where it finally disintegrates.

WILSON[10] has published a more detailed account of the work on which his preliminary paper[11] on *Urophlyctis* was based, but the conclusions of both are identical. The direct functioning of the resting body as a sporangium, and the production of the resting "spores" in lysigenous cavities developed in the host tissues by a parasitic plasmodium are maintained.

SCOTT[12] found that the resting spores germinate by the proliferation of one to fifteen sporangia through pores of which the zoospores escape. JONES's and DRECHSLER's limited observations on germination are in agreement with the latter. As for the accounts of cytological details and life cycle of the pathogen, it seems evident that JONES and DRECHSLER have made their observations upon very different material and probably a different organism from that studied by WILSON. Judgment as to which is actually the crown wart disease of alfalfa and which is *Urophlyctis alfalfae*, if that name is to survive, must remain temporarily suspended, but the fine preparations of JONES and DRECHSLER obtained by dissecting the parasite from infected tissues and showing in detail the relations of turbinate cells, hyphae, resting spores, and haustoria leave no doubt that the organism which is the type for *Urophlyctis* is the one they studied. On the other hand, WILSON has made

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[9] ORTON, C. R., and KERN, F. D., The potato wart disease. Penn. State College Agric. Exp. Sta. Bull. 156. pp. 16. *figs 4*. 1919.

[10] WILSON, O. T., Crown-gall of alfalfa. BOT. GAZ. **70**:51–68. *pls. 7–10*. 1920.

[11] ———, The crown-gall of alfalfa. Science **41**:797. 1915.

[12] SCOTT, C. E., A preliminary note on the germination of *Urophlyctis alfalfae*. Science **52**:225–226. 1920.

the association between resting spores and plasmodium on the basis of similarity of contents. The plasmodium may well be a secondary parasite. The existtence of an antheridial-oogonial sexual apparatus in *Urophlyctis* is definitely disproved, but WILSON's description of fusion between unlike zoospores must await confirmation.—FREEMAN WEISS.

Taxonomic notes.—HOCHREUTINER[13], in studying the Andean genus *Cristaria* (Malvaceae), has established two new subgenera (*Septaria* and *Aseptaria*), each including two new sections, besides describing several new species. In *Bakeridesia* also two new subgenera (*Monopteron* and *Dipteron*) are described, and one (*Pseudabutilastrum*) in *Malvastrum*.

DUNN[14] has described a new genus of Dipterocarpaceae (*Dioticarpus*) from Southern India. It is a valuable timber tree closely related to *Balanocarpus*.

WILDEMAN[15] has discussed various representatives of the African flora. *Clerodendron* (Verbenaceae) is represented by 31 species, 8 of which are described as new. *Acioa* (an African genus of Rosaceae) is credited with 37 species, 15 of which are new. A number of genera of Leguminosae are presented, including 23 new species distributed among 10 genera.

MOORE[16] has published the result of a study of the Australian collections at the British Museum, describing 89 new species in various families, and also a new genus (*Leptospermopsis*) of Myrtaceae.

DOP[17] has published 13 new species of *Clerodendron* (Verbenaceae) from Indo-China.

GAGNEPAIN[18] has published four new genera of Compositae from the Orient, as follows: *Camchaya*, *Iodocephalus*, and *Thorelia*, all belonging to Vernonieae, and *Colobogyne*, belonging to Coreopsidae.—J. M. C.

Welwitschia mirabilis.—When the third edition of *Morphology of Gymnosperms* by COULTER and CHAMBERLAIN was published in 1917, an important investigation of the floral structures of *Welwitschia* was overlooked. CHURCH[19]

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[13] HOCHREUTINER, B. P. G., Notes sur les genres *Cristaria*, *Bakeridesia*, *Malvastrum*. Ann. Conserv. Jard. Bot. Geneve **21**:405–428. 1920.

[14] Decades Kewenses: C.–CI. Kew Bull. 1920: no. 10. 1920.

[15] WILDEMAN, É. DE, Notes sur quelques espèces Africaines du genre *Clerodendron*. Bull. Jard. Bot. Bruxelles **7**:161–270. 1920.

[16] MOORE, S. LEM., A contribution to the flora of Australia. Jour. Linn. Soc. **45**:159–220. *pls. 11, 12.* 1920.

[17] DOP, PAUL, *Clerodendron* nouveaux de l'Indochine de l'herbier du muséum. Notulae Syst. Herb. Mus. Paris **4**:7–14. 1920.

[18] GAGNEPAIN, F., Quatre genres nouveaux de Composees. Notulae Syst. Herb. Mus. Paris **4**:14–19. 1920.

[19] CHURCH, A. H., On the floral mechanism of *Welwitschia mirabilis* Hooker. Phil. Trans. Roy. Soc. London **205**:115–151. *pls. 9–13.* 1914.